

Transition on the Ontario Broiler Chicken Farm to Modular Loading

FACTSHEET

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Introduction

Modular loading is a proven handling system for transporting birds from the farm to processing facilities (Figure 1). It has already been successfully implemented in many jurisdictions within North America and around the world. Modular loading improves loading efficiency, bird welfare during handling and transport, meat quality and food safety. As well, pressure from consumers regarding animal welfare is driving the conversion to this new system. In order to implement this modular loading in Ontario, it is important to build or modify poultry operations to maximize its benefits. This Factsheet explains how modular loading systems work and the physical requirements needed to use these modules.



Figure 1: Forklift placing empty, 5-tier CM2A module into second floor.

Modular Loading Systems

Modules are a series of molded plastic drawers set in a frame of welded metal tubing. Most companies use galvanized metal frames to resist corrosion as equipment is washed on a daily basis. Each module is lifted off the truck with a forklift and placed within the barn. Chicken catchers catch and place the birds directly into the drawers (rather than carry the birds across the barn) and pass them to other crew members, outside on the transport truck, to be placed into crates. The opening at the top of these drawers is much larger than the standard chicken crate currently in use, allowing for a more humane placement of birds and faster load times. The reduced handling of the chickens and the larger drawer openings combine to reduce the risk of injury to the birds (Figures 2a and 2b). Once all the drawers are filled, the forklift carries the module back to the truck



Figure 2a: Module with drawer extended for bird placement



Figure 2b: Chicken crate containing birds

Modular systems provide the opportunity for processing plants to incorporate gas stunning in the receiving area prior to shackling. This means that live birds are only handled once, from catch to shackle, resulting in further improvements in bird welfare, meat quality and food safety.

Module Equipment

There are many companies supplying module equipment to the broiler industry. Companies that currently make these systems include: Anglia Autoflow, Bright Coop Ltd., Linco Food Systems, Marel Stork Poultry Processing, Meyn Food Processing and CM2A. Note that these manufacturers are listed as examples and as sources for additional research. OMAFRA does not endorse or recommend any of these equipment manufacturers.

While there are subtle differences between the manufacturer's equipment, such as number of drawers, module height, empty weights, etc., there are also some similarities as this equipment must travel on regulation sized highway trailers. Table 1 provides a comparison showing a 5-tier high, full trailer width module from three of the supply companies.

The CM2A 5-tier module was selected for determining the expected floor loads for the barns because it is one of the first systems in use in Ontario. If your processor selects a different module than the CM2A, these loads will need to be verified.

Farm Information

A 2010 study identified that the sheer number and variety of barns used for growing chickens in Ontario is the biggest implementation challenge for a modular loading system¹. There are approximately 1,840 barns growing broiler chickens in Ontario. Of these, approximately 38% are single storey, 55% are two-storey, and 7% are three-storey or greater. The age of these barns varies from new construction to older than 40 years.

Building sizes, construction techniques and building codes have evolved over the years to reflect changes in technology and management practices (e.g., the use of larger manure cleanout tractors). A 30 year old, two-storey barn that was built according to the building code of the day is considered legal non-conforming, but it was not designed for the heavier floor loads shown in more recent codes.

Accommodating loaded modules on a pre-existing second floor in a two-storey barn requires a structural assessment by an engineer. It may also require some structural reinforcing to ensure that the building can safely handle the anticipated loads.

Catching companies may require a signed engineering report after conversion work is complete. This will assure them that every reasonable precaution has been taken to protect their workers from structural failure. It will also provide the farmer with a guarantee that the barn will not be damaged from the weight of loaded modules.

Unfortunately there are some barns that may never be able to accommodate modular loading equipment due to site restrictions or the prohibitive cost to retrofit these barns.

Table 1. Equipment specifications for various 5-tier high full trailer width modules

Manufacturer	Anglia	Linco	CM2A
# of drawer	15	10	15
Length of frame	2438 mm (96.0 in.)	2500 mm (98.4 in.)	2438 mm (96.0 in.)
Width of frame	1165 mm (45.9 in.)	1285 mm (50.6 in.)	1165 mm (45.9 in.)
Height of frame	1397 mm (55.0 in.)	1460 mm (57.5 in.)	1497 mm (58.9 in.)
Empty weight (frame + drawers)	390 kg (858 lb)	415 kg (913 lb)	427 kg (939 lb)
Maximum loaded weight (frame + drawers + birds)	1140 kg (2508 lb)	1265 kg (2783 lb)	1225 kg (2695 lb)
Bird weight/drawer	50.0 kg/drawer (110.0 lb)	85.0 kg/drawer (187.0 lb)	53.2 kg/drawer (117.3 lb)

Forklift Information

Forklift equipment required to move the modules at the farm site is quite specialized (Figure 3). It requires a low profile (mast height, cab height) to ensure that it can safely enter the barns without hitting equipment or the structure. It must be very maneuverable (tight turning radius) to work in restricted areas. It must also have the lift capability to handle the fully loaded modules and the reach to place these modules into second floor door openings.



Figure 3: Agile forklift for transporting modules.

Ideal New Barn for Modular Loading

The ideal new broiler barn design, to realize the most benefit from the modular loading technology, is a single-storey barn with a minimum 2.7 m (9 ft) ceiling height. The lack of internal support posts and high clearance allows for unimpeded forklift operation. Operators can place empty modules within a couple of feet of the chickens allowing catchers to simply load the birds with little walking. A crew of six catchers and one forklift can load a 16.2 m (53 ft) transport trailer in one hour or less from a single-storey barn

The 2.7 m (9 ft) ceiling allows for a minimum of 2.4 m (8 ft) clearance between litter and all suspended equipment (feed lines, waterlines, temperature/humidity sensors, etc.). Ideally, fixed equipment like gas lines and heating equipment or circulation fans should also have 2.4 m (8 ft) of clearance underneath or be located so they are not in forklift traffic lanes and have high reflective tape to improve visibility.

Remember that the forklift is normally operating at night in low lighting conditions making it difficult to see hanging equipment. Uneven litter can also cause the forklift to bounce when carrying modules.

Minimum end wall doorway openings for a forklift should be 2.4 m high x 3.0 m wide (8 ft high x 10 ft wide) to allow for ease of access. For barns longer than 91.5 m (300 ft) provide a second forklift doorway of the same dimension at the opposite end of the barn. This will reduce the travel distance for the forklift operator during loadout since half of the barn can be loaded from one end. The truck is then relocated to the other end of the barn to finish loadout. The forklift operator has to stay ahead of the catching crew bringing empty modules in a timely fashion so they are not standing around waiting. Excessive travel distances (>106 m or >350 ft) or manoeuvring require more time to complete these tasks and will result in a decrease of loading efficiency.

Locate a hard, level loading area (concrete or equivalent surface) measuring a minimum of 11 m x 16.8 m (36 ft x 55 ft) immediately outside the doorway to allow for forklift travel and turning during loading/unloading of modules from the transport truck (Figure 4). Extend the pad 1.5 m (5 ft) beyond the side of barn to ensure the transport truck is located far enough out to avoid ventilation fans extending from the side of the barn.

There should be a smooth transition between inside the barn and this loading area, i.e., no door sills or abrupt grade changes to prevent modules from bouncing during transport into or out of the barn by forklift. If the loading area is located on the same end of the barn as the solid manure storage, the pad may need to be extended to ensure the clear area (area not piled with manure) available for forklift travel equals the above listed minimum.

Drawings are for illustrative purposes and are not intended for use as building plans.

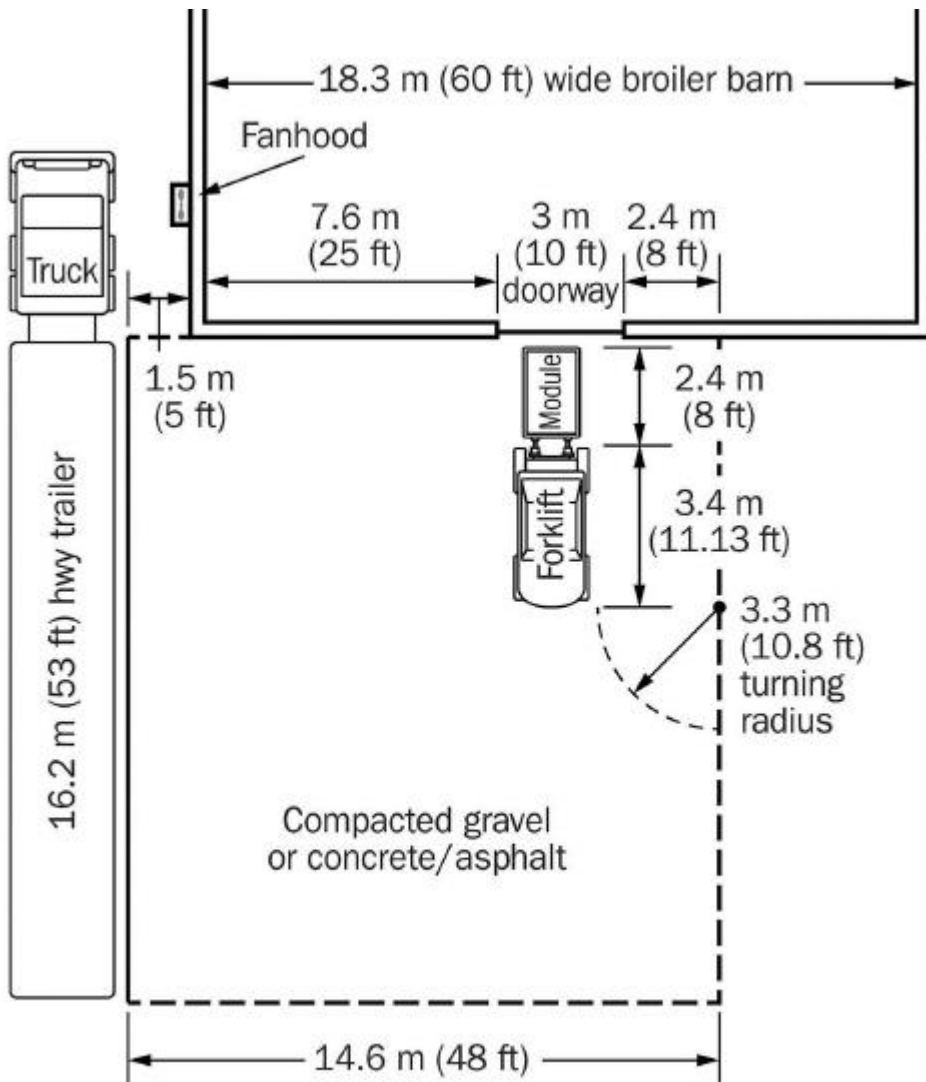


Figure 4: Schematic showing pad at end of barn to facilitate forklift turning during loadout.

The width of the barn will dictate the minimal width of the pad (Table 2)

Table 2. Minimum pad size for various barn widths

Barn Width m (ft)	Minimum Pad Width m (ft)	Minimum Pad Length m (ft)
12.2 (40)	11.0 (36)	16.8 (55)
15.2 (50)	13.10 (43)	16.8 (55)
18.2 (60)	14.6 (48)	16.8 (55)
21.3 (70)	16.2 (53)	16.8 (55)

Retrofitting Existing Barns to Receive Module

Existing Single-Storey or Ground Floor of Multi-Storey Barns

Many older barns were built with 2.4 m (8 ft) ceilings on the first floor. This provides a minimum clearance height of 2.1 m (7 ft) between the litter and all suspended equipment. Verify the actual forklift mast and cab height prior to initial loadout to ensure enough clearance. Forklift makes and models may vary in height so if equipment is changed clearance height needs to be re-verified.

Minimum end wall doorway opening for the forklift should be 2.4 m high x 3.0 m wide (8 ft high x 10 ft wide) to allow for ease of access. For barns longer than 91.5 m (300 ft), provide a second forklift doorway of the same dimension at the opposite end of the barn. This will reduce the travel distance for the forklift operator during loadout.

Locate a hard, level loading area (concrete or equivalent surface) measuring 11 m x 16.8 m (36 ft x 55 ft) immediately outside the doorway to allow for forklift travel and turning during loading/unloading of modules from the transport truck (Figure 4). There should be a smooth transition between inside the barn and this loading area, i.e., no door sills or abrupt grade changes, to prevent modules from bouncing during transport into or out of the barn by forklift.

For the ground floor of multi-storey barns the normal traffic pattern is down the middle of the barn between the rows of posts. In an ideal scenario, the posts are spaced far enough apart that a forklift can angle modules into openings between posts on opposite sides of the traffic lane (Figure 5). If the post spacing does not allow this then a different loading strategy may be required.

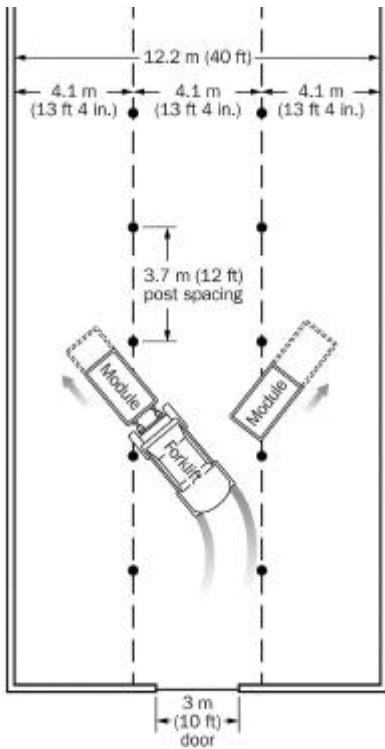


Figure 5: Schematic showing placement of modules on ground floor of multi-storey barn for loading.

Second Floor - Side Door Loading

Side door loading involves the widening and upgrading of the farm laneway along one side of the broiler barn (long axis). This 9.14 m (30 ft) wide, all season driving lane is necessary to allow the forklift enough room to maneuver. The forklift must be able to approach the barn door in a straight line to place the module in the doorway without catching the door sides (Figure 6). This laneway will need to be maintained all year - graded to prevent pothole formation and snow removed to allow the forklift to work in all weather conditions.

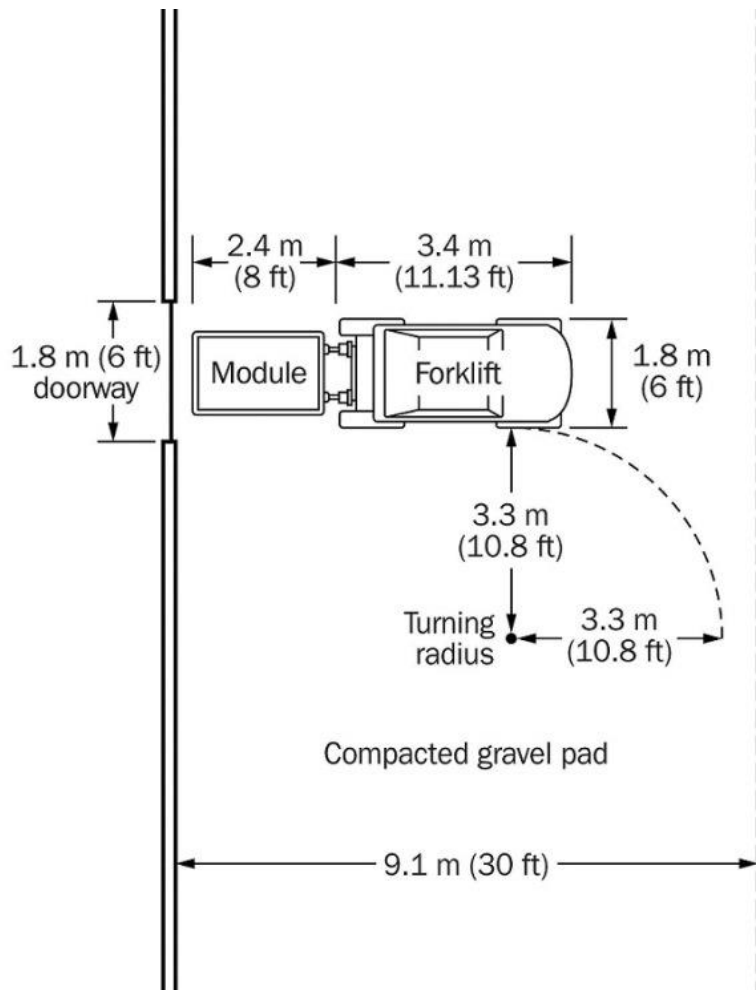


Figure 6: Schematic showing width of laneway needed for side door loading of second floor.

Side door loading is accomplished by removing the current loadout ramps from the outside of barn and widening the existing man doors to a minimum 2.1 m high x 1.8 m wide (7 ft high x 6 ft wide). This allows the forklift to place the modules into the second floor at the current 15.2 m (50 ft) doorway intervals. The widening of the doorway may involve the relocation or modification of ventilation equipment (exhaust fans or air inlets) depending on the barn layout.

Ideally there is no door sill across the bottom of doorways to impede the movement of the module into and out of the second floor doorway. Otherwise, a reinforced temporary plywood pad may need to be added so the module is high enough for forklift to access the slots on the module (Figure 7).



Figure 7: Loaded module on a temporary plywood pad to raise it above doorsill.

The second floor structure, in the immediate vicinity of the loadout doors, needs to be inspected by a structural engineer. Any repairs or design upgrades must be done to support a minimum distributed live load of 4.23 KPa (89 lbs/sq ft). This represents the maximum loaded weight of the CM2A module sitting on the floor which is a significantly higher floor load than presently required in the National Farm Building Code, 1995, for cleanout tractor plus litter.

Second Floor - Train Track Loading

Another option for loading modules on second floors involves the use of a portable roller track system placed down the long axis of the barn to move the modules. The use of this system is dependent on the processor purchasing and transporting this specialized equipment from farm to farm. Verify with your processor if they are planning to offer this system for second floor loadout. Some modular equipment manufacturers will not offer the train track option.

Structural loads imposed on the barn by the use of this system are significantly different from side door loading described previously. This is due to the location of track equipment in relation to floor support structure and the fact that the load will be moving as loaded modules are pushed over the roller tracks.

With a train track loading system, a door in the end wall measuring a minimum 2.4 m high x 3.0 m wide (8 ft high x 10 ft wide) is used to introduce equipment onto the second floor. This door is generally located above the ground floor end door so that the same hard surface pad area at end of barn can be used for the forklift to travel over.

The track runs lengthwise down the middle of the barn on top of any accumulated litter (Figure 8), usually at the mid-span of the floor joists. Initially a section of track is lifted into the second floor opening then a modified cart containing a specific number of 3.0 m (10 ft) track sections is placed on top of this starting track. Workers then take a section of track from this cart and attach it to the starter section. The cart is moved along the track as workers continue track assembly. The forklift operator will start unloading empty modules from the transport truck and placing them onto the track. Workers roll the empty modules along the track (either by hand or using a small push tractor) into the barn as far as necessary to fit all modules from the trailer into the barn. A typical 16.2 m (53 ft) trailer carries 26 modules. Catchers begin placing birds into modules at the end closest to the door. When a module is full it is moved to the doorway where the forklift picks it up and transfers it to the transport trailer.



Figure 8: Modules on train track system.

Design loads that must be considered by the structural engineer when reviewing the barn structure include:

- weight of loaded modules
- weight of the roller track system (56.8 kg/3.0 m or 125 lb/10 ft section)
- depth of litter on the floor, birds, people working around the modules
- weight of push tractor

Minimum design live loads to consider for this calculation include a uniform, distributed load of 2.0 KPa (41.8 lbs/sq ft) to account for floor birds plus litter accumulation (see National Farm Building Code, Table 2.2.1.A) and a line load of 5.1 KN/m located at center line of track system to account for loaded module plus track system.

Where a push tractor, weighing up to 700 kg (1540 lb) including the operator, is used to move the modules along the track on a second floor, the floor shall be designed for a two-wheel live load of 4.0 KN as required by the National Farm Building Code section 2.2.1.4. in addition to loads previously listed. Farmers should confirm the weight of this push tractor plus operator with the catching crew prior to introducing this equipment into barn.

Summary

The implementation of modular loading on your farm is dependent on your processing company. They will determine the timing and equipment selection. This Factsheet explains what modifications may be necessary to your pre-existing facilities to assist you in understanding the changes needed and to allow you to plan for this new technology if building a new barn.

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References

1. Business and Transition Plan: Modular Handling of Chickens in Ontario Chicken Industry - Association of Ontario Chicken Processors (2010)

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